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Giacone et al.

[11] **4,395,145**

[45] **Jul. 26, 1983**

[54] **SERIAL PRINTER**

[75] Inventors: **Felice Giacone,** Giaveno; **Raffaele Becchi; Boris Ukmar,** both of Ivrea, all of Italy

[73] Assignee: **Ing. C. Olivetti. & C., S.p.A.,** Italy

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[3] **B41J 1/24;** B41J 19/20; B41J 11/20

[52] **U.S. Cl.** **400/59;** 400/144.2; 400/175; 400/320; 400/322

[58] **Field of Search** 400/328, 320, 175, 56, 400/57, 59, 144.2, 144.3, 143, 144.1, 144, 162.1, 299, 320.1, 352, 354, 354.1, 683, 322

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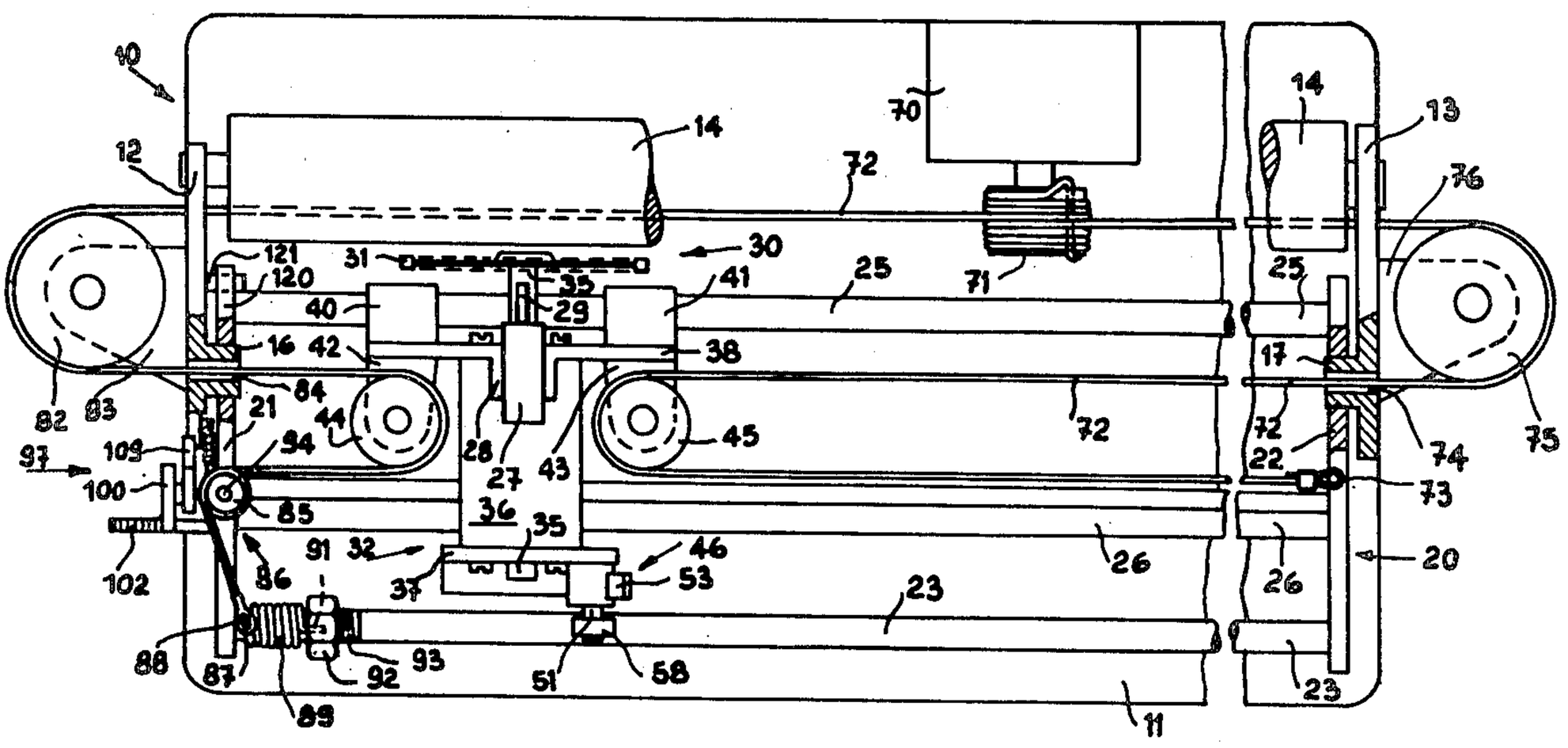
Primary Examiner—Edgar S. Burr

Attorney, Agent, or Firm—Schuyler, Banner, Birch, McKie & Beckett

[57] **ABSTRACT**

A serial printer comprises a carriage **32** movable parallel to a platen **14** and on which there is mounted a printing device **31,** for example of the daisy wheel type. The guides **23, 25** on which the carriage slide are mounted on a frame **20** which can turn with respect to the fixed sides of the machine on pivots **16, 17** to allow easy replacement of the daisy wheel. A motor **70** located beneath the roller constituting the platen effects displacement of the carriage along the writing line by means of a steel cable **72** and a series of return pulleys **44, 45, 75, 82.** The cable passes through coaxial holes **74, 84** in the pivots of the frame, in such a way that its conditions are not altered when the frame is turned. A unidirectional clutch **86** and a spring **89** coupled to one end **88** of the cable maintain the tension in the cable always constant, while providing a non-yielding anchorage when the motor pulls on that end of the cable.

14 Claims, 7 Drawing Figures



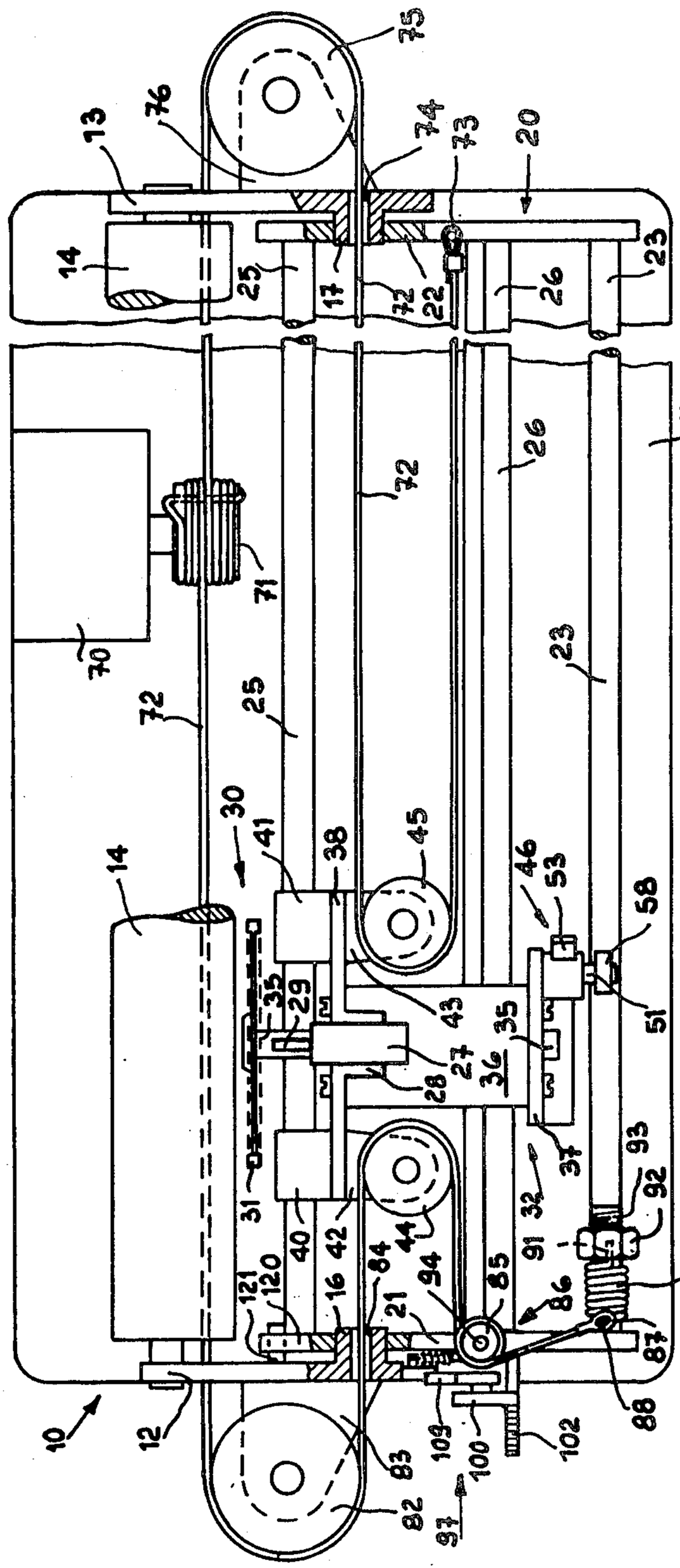

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FIG. 1

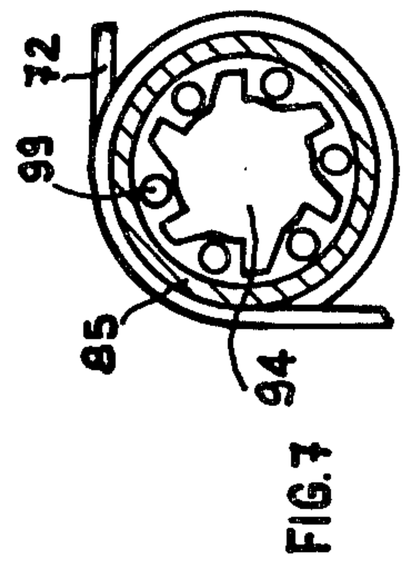
72
99
85
94

FIG. 7

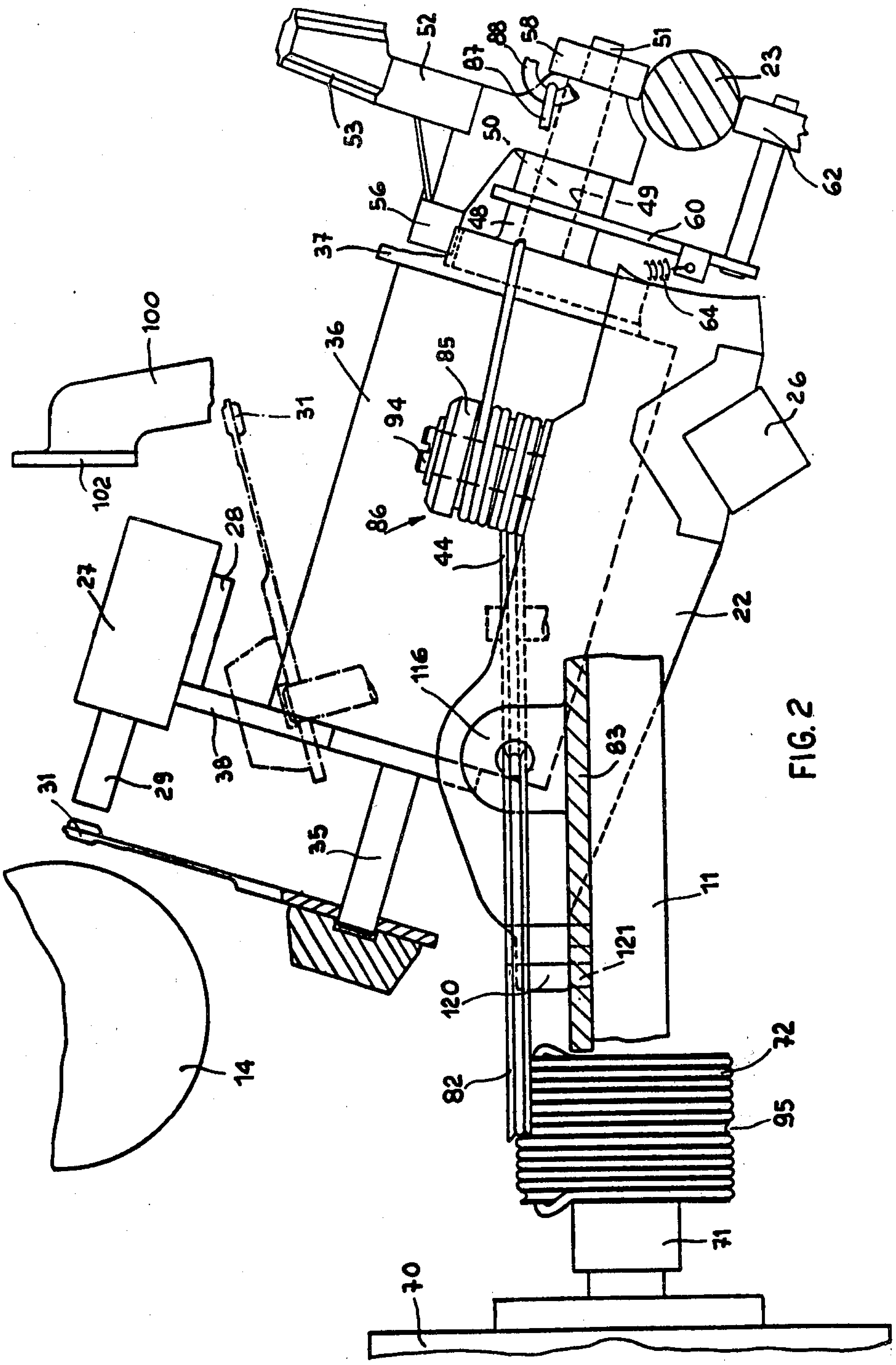

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FIG. 2

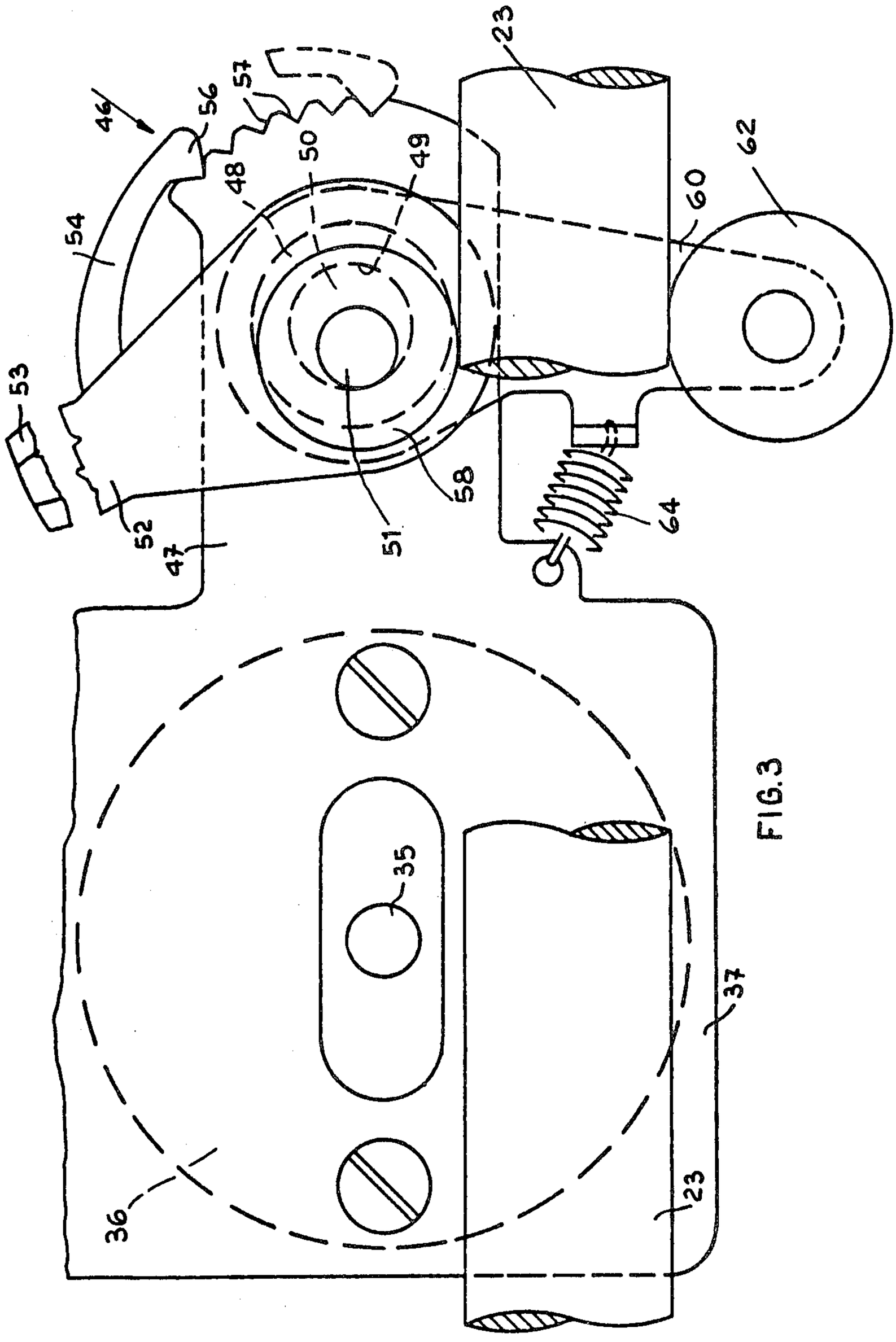

FIG.3

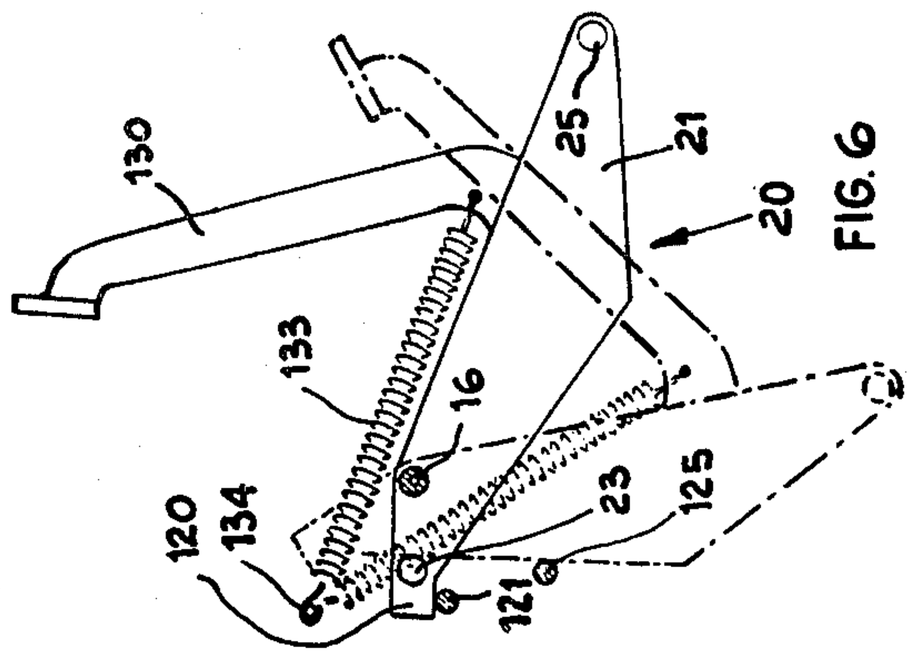

FIG. 6

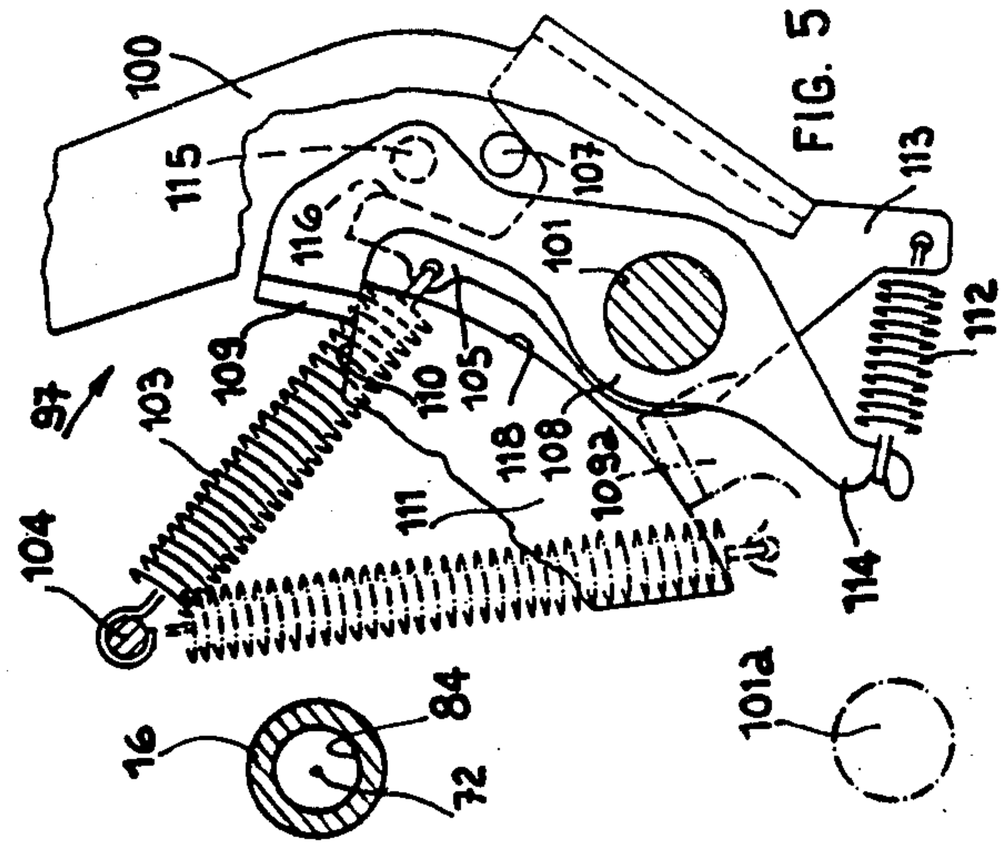

FIG. 5

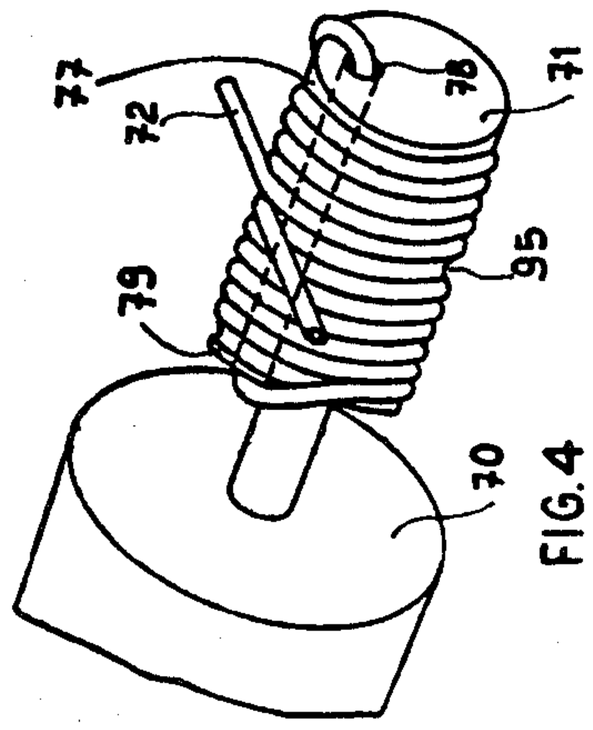

FIG. 4

SERIAL PRINTER

BACKGROUND OF THE INVENTION

The present invention relates to a serial printer comprising a platen rotatably mounted on a base, a carriage for supporting a printing device slidable on guides parallel to the platen, and a frame pivoted on the base of the machine and on which the guides are mounted.

A known serial printer comprises a printing unit carried by a carriage which slides transversely, along the length of the platen on a pair of guides, by means of a motor and a flexible cable for connection between the motor and the carriage. The guides on which the carriage slides are carried by a frame pivoted in a projecting manner on two lateral tongues of one end, on a relatively short fixed shaft which lies in a plane orthogonal to the platen. In the working position the frame is coupled to a side of the base and the guides lie parallel to the platen. By manually rotating it with respect to the shaft on which it is pivoted, the frame can be spaced from the other end of the platen in such a way that the user can gain access to the rear part of the printing device and the carriage for maintenance. This printer has the disadvantage of occupying considerable space when the frame is open and of not being suitable for accepting a keyboard or a control console in front of it. Moreover, the projection of the frame with respect to the base, and the weight of the motor, the carriage and the frame itself requires a very heavy structure the weight of which is borne on the pin and makes it subject to significant wear. A second disadvantage lies in the fact that the connection cable between the carriage and the motor and the various pulleys are subjected to wear which varies the geometric conditions between the parts so that the tension of the cable requires periodic adjustment.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a serial printer in which the frame on which the transverse carriage guides are mounted can be easily displaced with respect to the base to permit maintenance of the printing device, and which will be simple and reliable.

In accordance with this object, and for avoiding other disadvantages of the known printer, the frame of the serial printer according to the invention has two lateral pivots which lie adjacent to the lateral ends of the parallel guides on an axis parallel to the platen, in such a way that the guides can swing about this axis whilst remaining constantly parallel to the platen.

A second object of the present invention is that of providing a fast serial printer in which the geometric conditions between the parts connecting the motor and the carriage remain constant, and in which the flexible cable which connects the carriage to the motor is always subject to a predetermined constant tension.

In accordance with this second object, the cable which connects the carriage to the motor, in the printer according to the invention, is tensioned at one end by a spring with the interposition of a unidirectional clutch providing automatic take-up of any play in one direction and a substantially positive anchorage in the opposite direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the accompanying drawings, in which:

FIG. **1** is a partially sectioned plan view of a serial printer embodying the invention;

FIG. **2** is a first left hand side view, partially sectioned, which shows various details of the serial printer of FIG. **1**;

FIG. **3** is a partially sectioned front view of various details of FIG. **2**;

FIG. **4** is a perspective view on an enlarged scale of a first detail of the serial printer of FIG. **1**;

FIG. **5** is a second left side view, partially sectioned, which shows other details of the serial printer of FIG. **1**;

FIG. **6** is a left side view of a variant of the serial printer according to the invention; and

FIG. **7** is a sectioned plan view of a further detail of the printer of FIG. **1**.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. **1**, the serial printer **10** according to the invention comprises a base **11** having two lateral sides **12,13** between which there is rotatably mounted a platen roller **14**.

On two pivots **16,17** of the sides **12,13**, coaxial with a single axis parallel to the platen **14**, there is pivoted a frame **20** comprising two sides **21,22** parallel to the fixed sides **12,13**, two cylindrical guides **23** and **25**, parallel to the platen **14**, and a central bar **26** of substantially square section. A printing device **30**, including for example a character-carrying disc **31** of flexible blades, of the type described in U.S. Pat. No. 4,236,838 issued on Dec. 2, 1980 and assigned to the same assignee as the present application, is mounted on a carriage **32** slidable on the guides **23** and **25** parallel to the platen **14**. The disc **31** is mounted on a shaft **35** of an electric selector motor **36**, for example a stepping motor.

The carriage **32** (FIGS. **1** and **2**) includes a front flange **37** and a rear flange **38**, between which the motor **36** is arranged. On a front tongue **28** of the flange **38** there is mounted an electro-magnet **27** which controls a striker hammer **29** located in front of the character-carrying blade selected for the printing of the desired character. The striker **29** and the electro-magnet **27** are of known type and will not be described in detail here. The flange **38** carries at the front two horizontal tongues **42** and **43** on which are pivoted two pulleys **44** and **45** respectively. Finally, on the rear part of the flange **38**, there are fixed two bushes **40** and **41** for the sliding of the carriage on the guide **25**. The front flange **37**, (FIG. **3**) supports a mechanism **46** for the manual adjustment of the distance of the character-carrying disc **31** from the platen **14**. The mechanism **46** includes a lateral tongue **47** of the flange **37** (FIG. **3**) provided with a bush **48** (FIGS. **2** and **3**) having a central through hole **49** parallel to the shaft **35** of the motor **36**.

Within the hole **49** there is positioned a pivot pin **50** having an eccentric end portion **51**. To the pin **50** there is fixed a lever **52** provided with a knob **53** and a resilient tongue **54** having a wedge shape end **56** normally engaged in one notch of a series of notches **57** formed in an edge of the tongue **47**. On the end **51** of the pivot pin **50** there is rotatably mounted a ball bearing **58** slidable on the guide **23**.

A ball bearing **62**, also slidable on the guide **23** and counterposed with respect to the bearing **58**, is mounted

on a lever **60** which is also pivoted on the bush **48**. A spring **64** stretched between the lever **60** and the flange **37** holds the two bearings **58** and **62** constantly in contact with the guide **23**.

To control the displacement of the carriage **32** (FIG. **1**) in front of the platen **14**, there is provided a bidirectional motor **70** (FIGS. **1** and **2**) mounted on the base under the platen **14** in a median zone of the printer **10**. The motor **70** carries a drum **71** over which there is partially wound a central section of a flexible cable **72**, for example of steel. One branch of the cable **72** has a first end **73** fixed on the side **22** of the frame **20**; this branch of the cable **72** passes over the pulley **45** of the carriage **32**, traverses a through hole **74** coaxial with the pivot **17** of the side **13**, passes over a pulley **75** rotatably mounted on horizontal tongue **76** of the side **13** and is wound helically, from a central part towards an outer end **77** (FIG. **4**) on the drum **71**. From the end **77** the cable **72** passes through an axial hole **78** formed in the periphery of the drum **71** and emerges from an inner end **79**. The other branch of the cable **72** is helically wound from the inner end **79** as far as the central part of the drum **71** in the same sense as the first branch. This other branch of the cable **72** passes over a pulley **82** (FIG. **1**) rotatably mounted on a horizontal tongue **83** of the side **12**, traverses a through hole **84** coaxial with the pivot **16** of the side **12**, and passes over the pulley **44** of the carriage **32**. From here the cable **72** is helically wound on a rotatable part **85** (FIGS. **1** and **2**) of a uni-directional friction clutch **86**, and a second end **87** is fixed to a hook **88** of a helical spring **89** wound on the guide **23** close to the side **21** of the frame **20**. One end **91** of the spring **89** is connected to an adjustment nut **92** screwed on a threaded part **93** of the guide **23**, which allows both the tension and the length of the cable **72** emerging from the clutch **86** to be adjusted.

The uni-directional friction clutch **86** is of known type, and includes a central cylindrical stem **94** shaped as illustrated in FIG. **7**, which is fixed to the side **21** of the frame **20** and with respect to which the rotatable part **85** can turn only in the anti-clockwise sense (FIGS. **1** and **7**), due to the presence of balls **99** between the stem **94** and the part **85**. The drum **71** (FIG. **4**) is provided with a helical groove **95** formed on its periphery in order better to receive the cable **72**. The development of the groove **95** is greater than twice the path of the carriage **32** in front of the platen **14** in such a way as to leave turns of the cable **72** still wound on the drum **71** when the carriage is positioned at the two ends of the printing line.

The frame **20** (FIG. **1**), being pivoted on pivots **16** and **17**, can rotate with respect to the fixed sides **12** and **13**. A manually operable mechanism **97** (FIG. **5**) is provided for effecting such rotation. The mechanism **97** includes a bridge type lever **100** which is pivoted on a cylindrical end **101** of the bar **26** of the frame **20** and has a knob **102** (FIG. **1**) at its upper end. A lever **100** is constantly urged towards the platen **14** by a spring **103** (FIG. **5**) stretched between a fixed pin **104** of the side **12** and a tongue **105** of the lever **100** itself. In the rest condition the spring **103** pulls a rear end **120** of the frame **20** into abutment against a fixed stop **121** of the side **12** (FIGS. **1** and **2**). In this position the shaft **95** of the motor **36** is substantially horizontal and the character disc **31** is substantially vertical, with the upper blade located in front of the printing line on the platen **14**. A peg **107** (FIG. **5**) of the frame **20** limits the rotation of the lever **100** in the anti-clockwise sense. On the cylindrical end **101** there is also pivoted a hook lever **108** provided with a tooth **109** which in the rest position is hooked over an upper edg **110** of a small plate **111** fixed to the side **12**. A spring **112**, tensioned between an end **113** of the lever **100** and an end **114** of the lever **108** tends to make this latter turn in an anti-clockwise sense. The lever **108** is also provided with a pin **115** which can cooperate with a side **116** of the tongue **105**. The small plate **111** has a curved edge **118** which can cooperate with the tooth **109** of the lever **108**.

The operation of the serial printer described hereinabove is as follows.

In rest conditions, the frame **20** is located in the position illustrated in FIGS. **1** and **2**, that is to say with the guides **23** and **25** lying in a plane inclined by 17° with respect to the horizontal plane. In this position the character-carrying disc **31** has its blades located in an almost vertical plane ready for effecting printing of a character upon operation of the striker hammer **29**.

The distance of the printing unit **30** from the platen **14** is easily adjustable by means of the mechanism **46**. In fact, by manually turning the lever **52** (FIG. **3**) in a clockwise sense, the pin **50** also turns in the same sense raising the eccentric end **51** on which the bearing **58** is mounted. Consequently the flange **37** is lowered and the entire carriage **32** turns in a clockwise sense (FIG. **2**) with respect to the guide **25**, thus carrying the upper blades of the disc **31** a greater distance from the platen **14**. Similarly, by turning the lever **52** in an anti-clockwise sense (FIG. **3**) the disc **31** is brought closer to the platen **14**. In both cases the spring **64** ensures a constant contact of the bearings **58** and **62** on the front guide **23**. The eccentricity of the part **51** with respect to the pin **50** is such that by displacing the resilient tongue **54** together with the lever **52** from one notch **57** to the adjacent notch, the distance of the character-carrying blade is adjusted by 0.1 mm.

The movement of the carriage **32** on the guides **23** and **25** (FIG. **1**) is effected by the motor **70** via the cable **72**. The carriage **32** is displaced from right to left when the drum **71** turns in the clockwise sense (FIG. **4**), whilst it moves from left to right when, on the other hand, the drum **71** turns in the anti-clockwise sense.

When the printer is at rest the tension of the cable **72** (FIG. **1**) along the whole of its length from the end **73** to the end **87** is maintained constant by the spring **89**. This spring also prevents the branch of the cable **72** which runs from the drum **71** to the pulley **44** from becoming slack during translation movements of the carriage **32** in which this branch is not being pulled. The uni-directional clutch **86** represents, on the other hand, a rigid anchorage when the motor **70** accelerates the carriage during its movement from right to left, or rather when it brakes the carriage in its displacement from left to right putting maximum strain on the branch of the cable **72** which runs from the drum **71** to the pulley **44**.

Since the other branch of the cable **72** is rigidly anchored to the frame the two branches of the cable **72** are only subjected to the very limited resilient deformations due to the pull applied by the motor **70**. The rigidity of the transmission from the motor to the carriage is very high and entirely independent of the yielding of the spring **89**. This ensures a rapid response of the interconnection system with the motor **70** and a limited oscillation of the carriage with respect to the stopping positions.

During the adjustment of the printer necessary upon setting up, the spring **89** tensions the whole of the cable **72** which, during setting up, can become slack, including the region of the cable **72** lodged within the hole **78** of the drum **71** (FIG. **4**). Having positioned the carriage in its zero position one then proceeds to define the zero of the linkage system of the motor **70** for a correct position of the carriage **32** with respect to the platen **14** in a known manner which is not described in detail. When it is required to gain access to the character-carrying disc **31** mounted on the shaft **35**, for example to replace it with another, the frame **20** is turned with respect to the fixed pivots **16** and **17** by manually operating the mechanism **97** (FIGS. **1** and **5**). This operation can be effected independently of the position of the carriage **32** along the guides **23** and **25**.

The lever **100** is turned in a clockwise sense (FIG. **5**) against the action of the spring **103** until the side **116** of its tongue **105** comes into contact with the pin **115** of the lever **108**. After this, by continuing to turn the lever **100** in the clockwise sense the lever **108** is also turned in the same sense against the action of the spring **112**, and its tooth **109** becomes uncoupled from the upper edge **110** of the small plate **111**. This clockwise rotation of the levers **100** and **108** continues until the side **116** abuts against the peg **107** fixed on the side **21** of the frame **20**.

By pressing the lever **100** downwardly the whole frame **20** is now turned with respect to the pins **16** and **17** until the pin **101**, coaxial with the bar **26**, is carried into the position illustrated in broken lines in FIG. **5** and indicated **101***a*. In this new position the tooth **109** is located in the position shown in broken outline and indicated **109***a*. Moreover, the pin **101** and the bar **26** being located almost under the pins **16** and **17**, the guides **25** and **23** lie in a substantially horizontal plane. In this position the character-carrying disc **31** is spaced from the platen and is easily accessible by the operator; this position is illustrated in broken outline in FIG. **2**.

The cable **72**, during the rotation of the frame **20** on its pins **16** and **17** (FIG. **1**) does not change its adjustment and is only subjected to a negligible additional tension due to the torsion in the section lying between the pulley **44** and the pulley **82** and in the section lying between the pulley **45** and the pulley **75**.

To return the frame **20** into its rest position it is only necessary to raise the lever **100** until, by the effect of the springs **103** and **112**, the hook **109** disengages from the edge **110** of the plate **111** (FIG. **5**). This takes place when the rear end **120** of the side **21** (FIGS. **1** and **2**) is carried back into contact with the fixed stop **121**.

In a variant, illustrated in FIG. **6**, the mechanism **97** comprises a lever **130** fixed to the side **21** of the frame **20** in a zone intermediate between the pin **16** and the guide **25**, and a spring **133** which connects the lever **130** to a point **134** on the fixed side **12**. The spring **134**, in the rest condition, holds the frame **20** with its end **120** abutting against the stop **121**.

By lowering the lever **130** the frame **20** is made to turn in the clockwise sense about the pin **16** until the side **21** stops against a second peg **125** fixed to the side **12**. In this condition, illustrated in broken outline in FIG. **6**, the spring **133** stably holds the frame **20** in its new position.

From the above description it will be clear that the printing device **30** is mounted on a carriage **32** slidable on guides **23** and **25** parallel to the platen **14** and mounted on a frame **20** pivoted on the base **11**, and that the pivots **16** and **17** for the frame **20** lie on an axis parallel to the platen **14** in such a way that the frame **20** can turn on the pivots **16** and **17** whilst remaining parallel to the platen **14**.

It will also be clear that a bidirectional motor **70** controls the displacement of the carriage **32** along the guides **23** and **25** by means of a flexible cable **72**, that this cable **72** has a first end **73** fixed with respect to the guides, a central part wound on the shaft **71** of the motor **70**, and a second end **87** connected to a tension spring **89**, and that this cable **72**, at its second end **87**, is connected to a uni-directional clutch **86**.

For example, in place of a single flexible cable **72** there could be used two cables which may be connected at one end to the carriage **32** and at the other to the drum **71** of the motor **70**. Moreover, the printing device **30** rather than being of the character disc type can be of wire printing, each wire being operated by a corresponding selector electro-magnet, as described in U.S. Pat. No. 4,010,836 issued on Mar. 8, 1977 and assigned to the same assignee of the present invention.

What we claim is:

1. A serial printer comprising a base, a platen mounted on said base, a frame pivoted on said base and including guides parallel to said platen, a carriage slideable on said guides and a printing device mounted on said carriage, wherein said frame has two lateral pivots which lie adjacent to the lateral ends of said guides on an axis parallel to said platen in such a way that said guides can swing about said axis while remaining constantly parallel to said platen, wherein a motor mounted on said base controls the displacement of said carriage along said guides by means of a flexible connection cable, wherein a coaxial hole is provided in each one of said lateral pivots of said frame and wherein said flexible cable passes through the coaxial hole of said pivots.

2. A printer according to claim **1**, wherein said motor is bidirectional, and has a drum mounted on its shaft, wherein said cable has a central part wound on said motor drum and two runs maintained rectilinearly in a section lying between said pivots by a first pair of pulleys mounted on said base, and wherein said pulleys guide said cable from said rectilinear section to said central part.

3. A printer according to claim **2**, wherein said cable has its two ends fixed on anchorage parts of said frame and wherein a second pair of pulleys mounted on said carriage guide the runs of said cable from said rectilinear section to the anchorage parts of the frame.

4. A printer according to claim **1**, wherein said flexible cable has a first end fixed with respect to said frame, a central part wound on a shaft of said motor, and a second end tensioned by a spring with the interposition of a uni-directional clutch for automatically taking up any play in one direction and providing a substantially positive anchorage in the opposite direction.

5. A printer according to claim **1**, wherein said printing device includes a character disc positioned in front of said platen, a selector motor for the selection of the characters of the said disc, wherein said carriage comprises a front flange provided with a first slidable element on a first of said parallel guides and a rear flange provided with a second element slidable on a second of said parallel guides, and wherein said selector motor is mounted between said two flanges.

6. A printer according to claim **5**, wherein said character disc is mounted behind said rear flange on a shaft of said selector motor, and wherein an adjusting mechanism is mounted on said front flange for adjusting the

angle of the axis of the shaft of said selector motor with respect to the plane in which said guides lie whereby adjusting the distance of said character disc from said platen.

7. A printer according to claim **6**, wherein said mechanism comprises a pivot pin rotatably mounted on said front flange parallel to the axis of said motor shaft, an eccentric end of said pivot pin on which said first slidable element is mounted, and a lever connected to said pin for adjusting the eccentricity of said end with respect to said motor shaft.

8. A printer according to claim **7**, wherein said lever comprises a tooth engageable with a plurality of fixed notches and the displacement of said tooth of said lever from one to the adjacent of said fixed notches corresponds to the approach or separation of said character disc by 0.1 mm with respect to said platen.

9. A printer according to claim **1**, wherein said printing device comprises a character disc positioned in front of said platen, and wherein said frame is turnable between a first position in which said disc is substantially vertical and near to said platen, and a second position in which said disc is substantially horizontal and spaced from said platen.

10. A device according to claim **9**, wherein a single spring stretched between a fixed point on said base and a side of said frame holds said frame in said first and second positions.

11. A serial printer comprising a platen, two guides parallel to said platen, a carriage slideable on said two guides, a printing device mounted on said carriage, a bidirectional motor shaft for controlling the displacement of said carriage along said two guides, a helical spring wound on a support shaft fixed with respect to said two guides, a single flexible cable which connects said motor shaft to said carriage, said cable having a first end fixed with respect to said two guides, a central part wound on said motor shaft, a second end fixed to a first extremity of said helical spring, and a portion intermediate between said second end and said central part, a friction clutch on which is wound the intermediate portion of said cable, and means for allowing adjustment of the tension force and of the length of said flexible cable, said adjustment allowing means comprising an adjustment nut screwed on a threaded part of said support shaft and connected to a second extremity of said helical spring.

12. A serial printer according to claim **11**, wherein said friction clutch is of unidirectional type for automatically taking up any play in the direction of the tension force applied by said helical spring and for acting as a substantially positive anchorage in the opposite direction.

13. A serial printer according to claim **11**, wherein said support shaft is constituted by an end of one of said two guides.

14. A serial printer according to claim **13**, further comprising a side wall supporting said end of one of said two guides and an end of the other guide wherein said spring is located between said side wall and said nut, and wherein said friction clutch is supported by said side wall.

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